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The Impacts of a Revised Handwriting Curriculum on Independent Letter Formation and Motivation in a Montessori 3-6 Classroom

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Abstract

The purpose of this action research project was to observe the impacts of a revised handwriting curriculum on motivation for handwriting and independent letter formation in a Montessori 3-6 classroom. Participants in the four-week study included eight students aged 3.6 to 5.9 in a private Montessori school located in a small New England college town. The revised curriculum utilized Orton-Gillingham sequencing, plus new handwriting materials and opportunities. Data sources included a daily tally sheet to track handwriting work, daily writing samples, student interviews, and lesson plan/reflection sheets. Data showed that the average daily participation rate for all optional handwriting work was 80% and that age impacted work choice. Handwriting samples showed improvement in independent letter formation. Further research could study the impact of the new letter presentation sequence on the areas of reading and spelling; and explore the use of cursive handwriting materials with this age group.

Keywords: Montessori, handwriting, Orton-Gillingham, multisensory, early childhood

Handwriting is an important skill and an essential component of literacy (Beringer et al., 2019). In addition to its intrinsic value for enabling written expression, research shows that handwriting fluency enhances reading (James & Englehardt, 2012) and is linked to academic success in other subject areas. For example, in a situation which requires note-taking, a student with fluent handwriting is able to capture more information and concentrate on the content of the lecture rather than the mechanics of writing (Lust & Donica, 2011). Despite the value of handwriting, the frequency with which it is taught has declined both in schools and in teacher education programs (Asher & Estes, 2016; Hunter & Potvin, 2020); and there is a dearth of research on how handwriting is taught at the preschool level (Dinehart, 2015). In my role as a Montessori 3-6 teacher, I observed that children attempt to express themselves in writing even before they receive explicit handwriting instruction. Often, children's first efforts at writing are directed toward writing their own names. Long before students are told, "Put your name on your paper," they proudly label their own art. Even the youngest students make a consistently identifiable unique mark when asked to write their name, though there might not be any identifiable letters. As a teacher, I have wondered how to best guide them in their efforts because the Montessori materials for handwriting are limited.

Montessori materials are unique because they are designed for multisensory self-directed learning. Multisensory instruction means that the information to be learned is presented through several modalities such as visual, auditory, kinesthetic, and tactile, in order to enhance learning (Wong, 2013). The Montessori materials enable self-directed learning and independence by including a built-in control of error. Built-in control of error can include characteristics such as pieces fitting together in only one manner, an exact number of matching objects, or visual discrepancy. The first of the three traditional Montessori writing materials, the sandpaper letters

(see Figure 1), does not actually involve writing, but builds muscle memory for letter formation through tracing. A lesson on the sandpaper letters is multisensory and includes having the child watch and listen to the teacher speaking the sound while tracing the letter with the index and middle fingers. The child repeats these actions, using sight, touch, and sound to understand and remember the information. Unfortunately, the traditional sandpaper letters lack a built-in control of error. They do not include any markings to show top or bottom, so children may position the letters upside-down. They also lack guiding arrows to remind the children how to trace the letters correctly when they are working independently.

Figure 1. Early childhood Montessori sandpaper letters.

When children can hold a pencil, they are introduced to the second of the traditional Montessori writing materials, the metal insets (see Figure 2). Students refine their pencil grip and control as they use colored pencils to trace the frames and insets on 5-inch square papers.

Figure 2. Montessori metal insets.

After children have worked with the sandpaper letters and the metal insets, they marry the skills of letter formation and pencil control to write letters on chalk boards. The chalkboards do not contain a built-in control of error to guide children how to correctly form the letters when they are working independently.

These three materials were the only handwriting-related curriculum included in my Montessori teacher training. In my experience, these materials do not fully meet the needs of the children who are eager to write for several reasons. First, the lack of control of error in the sandpaper letters and chalkboards means that children may not have learned how to form the letters correctly when working independently. Second, with only three handwriting materials, the children lack a breadth of practice opportunities. Lastly, in my experience, children often exhaust these three materials during the second year of their three-year cycle in the classroom and need additional handwriting opportunities and practice in order to continue to develop fluency. Due to the importance of handwriting, I want to ensure that I offer effective, sequenced instruction with Montessori-friendly materials (i.e. that are multisensory and enable self-directed learning), as well as meaningful handwriting opportunities. To that end I proposed the following research question: How would a revised handwriting curriculum impact independent letter formation and motivation for handwriting in my Montessori 3-6 classroom?

Theoretical Framework

Montessori philosophy offers a comprehensive framework for observing, understanding, and educating children. Within this framework, three aspects that help teachers and researchers to think critically about teaching methods and educational materials are independence, sensitive periods, and multisensory education.

Dr. Montessori was, first and foremost, an observer of children. She likened the ideal teacher to a scientist in the sense that she should have a spirit of curiosity. A teacher should observe with the "expectant attitude of one who has prepared an experiment and who awaits a revelation from it" (Montessori, 1964, p. 9). The experiment, in this case, is the environment that the teacher has prepared for the child. For Montessorians, fostering independence is the first goal of the prepared environment. Montessori wrote:

> The child's first instinct is to carry out his actions by himself, without anyone helping him, and his first conscious bid for independence is made when he defends himself against those who try to do the action for him. To succeed by himself he intensifies his efforts (Montessori, 1995, p. 91).

Montessori teachers prepare lessons and materials with independence in mind by including a built-in control of error or feedback mechanism so that children can work successfully without a teacher.

The work to which children are drawn in a Montessori environment reveals another aspect of Montessori philosophy called sensitive periods. Children go through sensitive periods in their development, or phases in which they display a particular interest and aptitude for learning a specific subject or skill. E.M. Standing wrote:

> When the education of children is organized in relation to their sensitive periods, they work with a sustained enthusiasm which has to be seen in order to be believed. Then "all is easy, all is eagerness, all is life; and every effort brings an increase of power" (Standing, 1998, p. 133).

According to Montessori, the sensitive period for writing is from age 3.5 to 4.5. Montessori noted that children are drawn to the sensorial aspect of writing and are interested in the fact that each letter has a corresponding sound (Standing, 1998).

Multisensory education is a third aspect of Montessori philosophy that informs this framework for analysis and intervention. Montessori wrote that, "The hand is the instrument of intelligence. The child needs to manipulate objects and to gain experience by touching and handling." (Montessori, 2012, p. 14). Throughout the Montessori classroom, children manipulate didactic materials designed to promote children's self-discovery of size, form, color, quantity, and physical properties. In the language area, children engage three senses when they see and speak letter sounds while tracing sandpaper letters with their fingers.

The Montessori philosophy, specifically its tenets of independence, sensitive periods, and multisensory education, is an appropriate framework for this action research project around handwriting in a Montessori primary classroom. The children in the classroom are aged 3.5-4.5 and are in the sensitive period for writing. Handwriting is a direct example of knowledge being in the hand first. The problem that I have identified in my classroom is that there is a gap in the Montessori materials for handwriting, which limits children's ability to independently practice correct letter formation and to make the transition from the tracing the sandpaper letters and manipulating the letters of the moveable alphabet to writing letters with pencil and paper.

Review of Literature

Trends in literacy education and research are continually shifting (Giles & Tunks, 2015). While the most basic definition of literacy is the ability to read and write, current research reflects an expanded definition which includes listening, speaking, reading, and writing

(Berninger et al., 2019). The Montessori primary (ages 3-6) classroom is a language-rich environment that offers children the opportunity to build literacy through multisensory materials that engage the ears, eyes, mouth, and hands (Lillard, 1972, p. 127). Children use their ears and mouth to hear and speak a wide variety of vocabulary. Children build descriptive vocabulary related to the senses, learn how to express quantity and numerical concepts, label the parts of plants and animals, and discuss physical and human geography. Children learn to communicate effectively with peers while working together on lessons designed to be social, such as the bank game. They practice grace and courtesy with scripted lessons, which they eventually internalize and make their own. Children's eyes take in the visual information of language as they see written letters and words around them and become readers. Children use their hands to manipulate didactic materials throughout the classroom to understand relative size, shape, and quantity. In the Montessori classroom, the hand impacts literacy through handwriting. This literature review will discuss the importance of the hand, how handwriting affects the brain and academic achievement, barriers to handwriting instruction, handwriting curriculums, and handwriting materials in the Montessori primary classroom.

Hands hold a special place of honor in Montessori education. In her London Lectures, Montessori described the hand as "the instrument of intelligence" and an entire chapter is devoted to asserting the belief that children must manipulate objects and gain knowledge and experience by touching and handling materials. (Montessori, 1946, p. 165-171). Montessori described the sense of touch as the stereognostic sense and designed didactic materials such as matching fabrics by touch alone. Children build strength, control, and coordination in their hands through the practical life exercises of scooping, pouring, squeezing, and twisting. They indirectly prepare the hand for writing by using tools such as tweezers, tongs, clothespins,

scissors, and pin punching. More than one hundred years after the founding of the first Montessori Children's House, modern research supports the importance of focusing on the hand and handwriting. Dr. Frank Wilson, a neurologist recognized for his work about the evolutionary development of the hand, wrote about its connection to young children's perceptual, motor, and cognitive growth. He emphasized that children must learn with their hands, as the hands are the primary channel through which the brain understands the world. Wilson also noted that children cannot bypass the process of learning information relevant to early literacy by gazing passively at visually mediated simulations on a screen (Wilson, 1998). Fine motor skills impact handwriting development, and an immature pencil grip in preschool can impede students' abilities to produce letters accurately (Dinehart, 2015).

Research in neuropsychology confirms that handwriting affects the brain differently than other language activities such as typing. Handwriting facilitates letter perception and improves letter processing in the brain. James and Englehardt (2012) reported that functional MRI scans show that the "reading circuit" is activated with handwriting, but not with typing or tracing. The connection between handwriting and letter recognition can be attributed to writing movements in the shapes of letters. The writing enhances memorization, which in turn enhances word recognition (Bara et al., 2018). Handwriting has also been shown to connect the different areas of the brain responsible for visual tasks and motor tasks in a way that does not happen when typing (Vinci-Booher et al., 2016).

Handwriting quality can positively or negatively impact academic achievement. Lust & Donica (2011) noted a positive correlation between handwriting quality and success in reading. In contrast, Graham (2018) wrote that readers and teachers form a negative opinion of the writer's ideas if they are presented in handwriting that is difficult to read or illegible, which in

turn can negatively impact a student's grade. Children who struggle with handwriting spend more effort and attention on the mechanical act of writing than the content of the composition (Jones & Christensen, 1999), and experience frustration, decreased self-worth, and lack of motivation (Berninger & Graham, 1998).

Despite the important role of handwriting on overall literacy and the positive effects of handwriting, there are barriers to handwriting instruction. Handwriting is undervalued in the digital age. Graham (2018) notes that the progression from typewriter to word processing, computers, phone, and even speech-to-text applications means that much of the writing done in peoples' daily lives is created on devices. Schools have removed handwriting instruction from their curriculum because of the Common Core Standards and the pressures of standardized testing (Asher & Estes, 2016). Forty-one states have adopted the Common Core standards, which include guidelines for writing, but not for handwriting skills. The Common Core guideline for kindergarten states that students will use a combination of drawing, dictating, and writing to express opinions and facts. The Common Core first-grade standard eliminates the options of drawing and dictating and states that students will write to express opinions and facts. Without a Common Core standard for handwriting, there is no accounting for how students will move from the kindergarten skill set, which includes drawing and dictation, to the first-grade requirement for pure written expression (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010).

Another barrier to handwriting instruction is disagreement on a foundational level of how and when to teach literacy skills most effectively. In one camp it is believed explicit instruction in the discrete skills of literacy such as phonics and handwriting are the most effective path to literacy; that explicit handwriting instruction is the basis for more advanced writing later

(Puranik & Lonigan, 2011). The other camp follows a social constructivist theory of literacy which believes children construct meaning through everyday literacy activities. This perspective, known as whole language or emergent writing, advocates for allowing children to express themselves freely and focus on meaning and content rather than letter formation or handwriting quality. Whole language advocates eschew discrete handwriting instruction for fear of discouraging children's interest in writing by focusing on mechanics. (Dennis & Votteler, 2012; Giles & Tunks, 2015).

Successful handwriting interventions have identified various factors that may, individually or in combination, improve student handwriting. Kaiser, Albaret, & Doutin (2011) identified intensity (i.e. frequency of instruction), explicit instruction, and self-assessment as key factors in successful handwriting programs. Cahill (2009) wrote that multi-part interventions that address factors intrinsic to the student (e.g. hand strength, body position, motivation, and visual-motor integration skills) and extrinsic to the task (e.g. the type of writing utensil, paper, and desk) are more successful than those which focus on one factor alone. Students' motivation to master the skill increased taught handwriting within a meaningful context and for a purposeful reason (Denton, et al., 2006), such as writing one's own name (Green, 1998; Haney, 2002; Puranik & Lonigan, 2011). Daily blocked handwriting practice, focusing on repeatedly practicing predictable and specific skills such as writing the day of the week, was also effective (Christensen, 2005).

At the preschool level, there is a dearth of research on teaching handwriting to this age group (Dinehart, 2015). This may be due to general disagreement about when to teach handwriting. Bara and Bonneton-Botte (2018) wrote that the link between fine motor development and learning handwriting makes it inappropriate for 5-year-olds, and that children

should engage in other activities that support the development of letter perception. In contrast, Puranik and Lonigan (2011) found that approximately 77% of the three-year-olds sampled in their study produced some letters of the alphabet. By age four and age five, approximately 93% and 95%, respectively, produced letters accurately. After a successful handwriting intervention with 2nd graders, Roessingh and Bence (2018) recommended an earlier focus on handwriting intervention in kindergarten as a more appropriate time frame. Dinehart (2015) noted that legibility and speed in later childhood handwriting requires the development of foundational skills that begin before a child enters kindergarten.

Although teachers believe that handwriting is important, many teachers do not feel like they received adequate instruction on teaching handwriting (Hunter & Potvin, 2020). In a survey reported by Graham et al. (2008), the participating elementary school teachers were asked to indicate how much formal preparation on teaching handwriting they received in the teacher education courses they took in college. They rated their amount of formal preparation on a 6 point scale: 0 indicated no preparation, 2 minimal preparation, 4 adequate preparation, and 6 extensive preparation. Their average score was less than 2 (minimal preparation) and, overall, only 12% of the teachers rated their training above a 4 (adequate). Ten years later, teachers still reported that the lack of formalized training impacted their teaching practices related to handwriting instruction (Nye & Sood, 2018).

Teachers prefer to teach curriculum-based handwriting in order to assure that there are no gaps in student knowledge and to save preparation time (Hunter & Potvin, 2020). Three out of every five teachers indicated that they used commercial materials for handwriting instruction. Ninety percent of these teachers used one of the well-known basal handwriting programs, such as the Zaner-Bloser program (Graham et al., 2008). In addition to the Zaner-Bloser program

previously noted, commonly used curriculum-based handwriting programs include: Handwriting Without Tears (HWT), Write Start, Handwriting Without Tears–Get Set for School, Peterson Directed Handwriting Curriculum, Fine Motor and Early Writing Pre-K, Orton-Gillingham, and the Size Matters Handwriting Program (Engel, Lillie, Zurawski, & Travers, 2018). The most researched of these programs is Handwriting Without Tears (HWT) and Handwriting Without Tears- Get Set for School. Handwriting Without Tears- Get Set for School is a program designed for preschool students beginning with capital letters and includes multisensory activities such as building the letters with wooden pieces. It has been used in diverse settings with a variety of learners such as Head Start classrooms (Lust & Donica, 2011), Montessori classrooms (Carlson, 2015), kindergartners (Randall, 2018), first-graders (Hape et al., 2014), (Schneck et al., 2012) and learners with Down's Syndrome (Patton & Hutton, 2017).

Despite Handwriting Without Tears- Get Set For School's widespread use, its focuses on capital letters conflicts with letters and language teaching in traditional Montessori classrooms. Maria Montessori specifically deprecated the teaching of capital letters. Through observation, Montessori found that children naturally produce curved lines first. Additionally, most text that children read is lowercase letters (Montessori, 1964, p. 252). The Orton-Gillingham method of handwriting is one component of a larger literacy approach originally developed in the 1930s by Dr. Samuel T. Orton, a neurologist; and Anna Gillingham, a psychologist and educator. The original purpose of the method was to help struggling readers and those now diagnosed as dyslexic. The Orton-Gillingham approach is multisensory and incorporates sight, hearing, touch, and movement to help students learn letter formation, sounds, and phonics (Institute for Multi-sensory Education, n.d.).

Montessori Handwriting Materials

Montessori handwriting instruction encompasses many of the elements previously identified with positive outcomes in other handwriting programs, including being multisensory and offering explicit instruction. Traditional materials for handwriting instruction in the modern Montessori primary environment include sandpaper letters, metal insets, and chalkboards. Students begin the process of learning letter formation with the sandpaper letters. The standard sandpaper letters used by most classrooms are lowercase, print letters cut out of sandpaper and mounted on pink or blue boards for consonants and vowels respectively. The teacher models how to trace the sandpaper letters with the fingertips while speaking the letter's sound. Students develop pencil skills by tracing the metal insets, a set of ten different frames with a removable inset shape. After pencil practice with the metal insets, students marry the letter formation skills learned from the sandpaper letters with the pencil skills practiced with the metal insets to begin to form letters on plain and lined chalkboards. Students are asked to self-asses and circle their best attempt. The jump from working with these pre-writing materials to writing letters with paper and pencil has been called the "explosion into writing" (Standing, 1998, p. 47).

Despite this promise of success, many Montessori teachers seek additional handwriting materials or curriculum (Candler, Mulder, & Nall, 2014; Carlson, 2015; Valdez 2014). This search may be due to several facts. First, there is no prescribed order of introduction for the letters or a prescribed letter formation method. Second, the materials do not allow for auto-education as the student must rely on the teacher as the control of error to ensure proper letter formation. Third, many students would benefit from additional guided letter formation after the sandpaper letters and before writing letters with chalk or pencils. Montessori's own writings describe a guided tracing material consisting of a wooden stick that could move in an indented

furrow or trough in order to give a mechanical guide to follow the exactness of a trace (Montessori, 1964). This is not part of the modern Montessori practice, but might provide an intermediary step for children who struggle with correct letter formation. Lastly, there are no prescribed writing activities for children who are ready to move beyond the formation of single letters on the chalkboards.

Methodology

The purpose of the study was to explore the effects of a revised handwriting curriculum on student motivation for handwriting and students' ability to independently form letters correctly. The revised curriculum utilized new writing materials which included a control-of-error and added new name-writing opportunities integrated into the daily classroom routines. Qualitative and quantitative data was collected over the course of the four-week study period.

Participants

The participants for this action research study were Montessori students enrolled in one of two primary (3-6) classes in a private Montessori school. The school is located in a small college town in New England. Normally, the school serves approximately 60 students in two toddler classrooms and two primary classrooms. Due to the global pandemic, enrollment was reduced to approximately thirty students in three classrooms. The sample size was 8 students total, and consisted of four first year primary students, one second year primary student, and three third year primary students. The sample included four boys and four girls. The composition of the classroom was different than expected when the research was planned, as I expected to include 4-8 additional four and five-year-old students. I am an AMS-certified Montessori 3-6 teacher with nine years of teaching experience, including four years in this particular classroom.

Description of Intervention

The first element of the intervention was to rearrange the composition of the sandpaper letter baskets in the classroom and to add an additional set of sandpaper letters that included directional arrows. The Didax educational company produced the new sandpaper letter set, and they were purchased from the Institute for Multisensory Education (IMSE). The Didax letters are lowercase letters cut out of sandpaper and affixed to orange cardboard backing, approximately three inches wide and five inches tall (see Figure 3). They also include a starting dot and numbered directional arrows to show how the letter is formed.

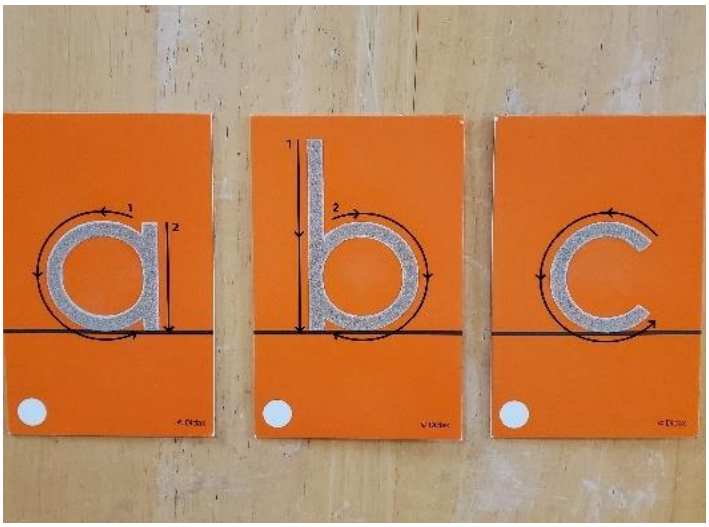


Figure 3. Didax sandpaper letters with starting dots and directional arrows.

The new letters are contained in a small plastic box which I added to the original baskets of Montessori sandpaper letters. Children were allowed to work with the baskets at any time. Prior to this intervention, the sandpaper letters in my classroom were divided into five separate baskets with a vowel as the anchor letter and additional consonants that could be paired to form short words. I utilized the Orton-Gillingham order of letter presentation to rearrange the contents of the baskets to group the letters by similarity of how they are formed when writing. Table 1 shows

the new order of presentation beginning with the letter c in basket 1 and ending with the letter q in basket 5.

Table 1

Contents of Sandpaper Letter Baskets Pre and Post Intervention.

	Previous contents with vowel as anchor letter	New contents presented in order of letter formation
Basket 1	a, b, t, f, m	c, o, a, d, g
Basket 2	e, r, c, g, h	l, h, t, i, j, k
Basket 3	i, s, k, d, l	p, u, b, r, f
Basket 4	o, n, v, j, p	m, n, e, s
Basket 5	u, z, x, w, q, y	w, y, v, x, z, q

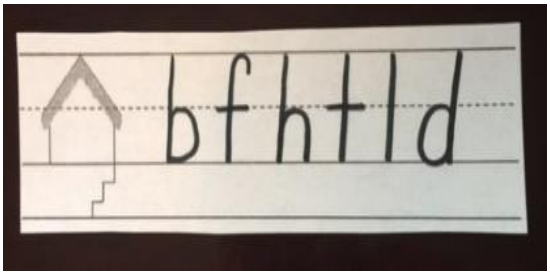
The second element of my intervention was to schedule a featured "letter of the day." The letters were presented in the order listed in the baskets above. The feature letter "c" was introduced on day 1 and the feature letter "s" was presented on day 20, the last day of my four-week data collection period. The remaining six letters, Basket 5, were presented after the research period ended. Each day during the morning meeting, I gave a large group lesson on the letter of the day that included showing and tracing both the Montessori sandpaper letter and the OG sandpaper letter. I also wrote the letter on a large whiteboard that hangs on the wall in the meeting area. The students and I brainstormed words that begin with the featured sound. At the end of the lesson, the Montessori sandpaper letter and the Didax sandpaper letter were returned to the appropriate basket. A third copy of the letter of the day in the form of a printed and

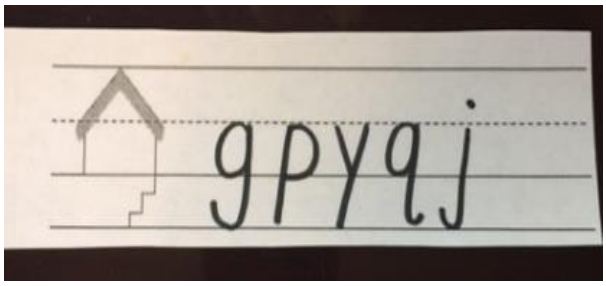
laminated card was added to a separate work basket of OG letter cards. This basket was designed to accompany the writing work on the shelves. For example, students who chose to work with the sand tray, chalk board, or white board could bring the basket of laminated letter cards to their workspace to serve as a reference. In addition to the large group lesson on the letter of the day, I gave individual and small group lessons to the students. I gave individual lessons whenever the letter of the day appeared in the student's name. These lessons were usually ten minutes long and each student had one or two lessons per week throughout the four-week intervention. Two or three times per week I gave short (i.e. five to ten minute) small group lessons to the three third year students in the afternoon while the younger students were resting.

The third element of my intervention was to add new multisensory writing materials and writing utensils to the classroom. The new materials included the Didax sandpaper letters previously described, a sand tray for writing individual letters with a basket of OG letter cards for reference (see Figure 4), a tray with laminated lowercase letter mats for forming the letters with play-doh (see Figure 5), a letter tracing board with a stylus, and a small white board with a reference letter strip mounted at the top (see Figure 6).

Figures 4, 5, and 6. New sand tray with letter formation cards, play-doh letter mats, and white board with new writing utensils.

I also added special OG “house” paper in a paper tray on the language shelf. The house paper includes a small house diagram imposed on the four lines in order to assist with letter heights. For example, the letter “l” starts in the attic and the letter “j” goes into the basement (see Figures 7 and 8).





Figures 7 and 8. House paper

In addition to the new writing work, I added new writing utensils. I placed three pencil holders on the writing shelf, each containing a different writing utensil. The new utensils included triangular pencils, regular pencils with rubber writing grips, and conventional round pencils. Students were free to choose their preferred writing utensil. Special cleaning protocols in place due to Covid-19 altered classroom procedures around small items such as pencils, crayons, scissors, etc. Under normal circumstances, I would have placed one writing utensil of my choice with each work, and each student who used the work would use the same writing utensil. During this intervention, students were asked to place their used writing utensils into a separate tray for cleaning. Because of this cleaning protocol, I was able to observe which utensils were used most often each day, but this information was not recorded or analyzed.

The fourth element of my intervention was to add opportunities for name-writing throughout the day. Children were asked to write their names on a daily sign-in sheet when they entered the classroom each morning, and on the snack log sheet after they finished their snack. A third, optional, opportunity for name-writing was the Question of the Day. Each day I posed

an opinion question with two possible answers, and children could write their name in the column under their selection. In addition to the printed question, there was a picture at the top of each answer column to assist non-readers.

Data Collection

Four data collection tools were used during the intervention. Three of the tools collected qualitative data, while one was used to collect quantitative data.

Qualitative data

The three forms of qualitative data collected throughout the study period included questionnaires, teacher logs and writing samples. First, data on students' feelings about handwriting from teacher/student conversations was collected using a questionnaire (Appendix A). The questionnaire contained five open-ended questions around the new handwriting work and the child's feelings about handwriting. Children were asked to identify their favorite new work, writing utensil, and favorite words to write. They were also asked how they felt about handwriting, and if they would like to have more or less handwriting work in the classroom. The students completed the questionnaire after week one and after week four of the intervention.

A second form of qualitative data was collected in the form of a weekly lesson plan/reflection log sheet (Appendix B). The purpose of the log sheets was to schedule the letter of the day and record individual lessons and reflections. The third form of qualitative data was daily handwriting samples. Samples were collected two or three times per day when students wrote their names on the daily sign-in sheet (Appendix C), Question of the Day sheet (Appendix D), and snack log (Appendix E). The Question of the Day was an optional activity, therefore not every student participated on a daily basis. The three data tools referenced yielded 30-60 name writing samples from each student. The samples were used to discover if the students' name

writing changed over the course of the intervention with regard to letter reversals, capitalization, spelling, and placement.

Quantitative data

Quantitative data was collected on a daily tally sheet where my assistant and I recorded the students' choices of handwriting-related work. There were ten core handwriting activities listed on the tally sheet. Five of the activities were in the classroom prior to the research period and five of the activities were added as part of the research. Data collected included how many times each activity was selected, how many total handwriting works were selected, and the age of the students who selected the work. In addition to its use as a qualitative handwriting artifact, the Question of the Day sheet was also used as quantitative data tool. As such, it was the 11th handwriting work in the classroom and was included in the overall daily participation rate for handwriting work. The intent of these two data tools was to track students' motivation for handwriting-related activities by calculating participation in these eleven optional activities. (Appendix F).

Analysis of Data

The data collected using the four data tools designed for this research project was analyzed to gauge motivation, as indicated by participation levels and student feedback; and to determine if the quality of student handwriting improved. Additionally, the collected data revealed which specific handwriting works were most popular among the students, how age impacted results, and how the students felt about the project.

Motivation for Handwriting

Motivation for handwriting was assessed by determining the participation rate in handwriting-related activities for each day of the intervention. Two data tools were used to

collect the information. The first tool was the daily handwriting tally sheet and the second tool was the Question of the Day activity.

Daily handwriting tally sheet

The daily handwriting tally sheet (Appendix F) was used to record student work choices from the ten core handwriting works, excluding the Question of the Day, which was tracked separately. All the work tracked was optional. My assistant and I observed and recorded each time one of the ten core activities were selected and by whom. The purpose of the record was to determine the overall percentage of students who engaged in handwriting-related work, which works were most popular, and whether age was a factor in motivation for selecting handwriting work.

Question of the Day

The Question of the Day (Appendix D) was an activity that consisted of an 8.5" x 11" sheet of paper that was placed at a designated desk during the work cycle. A simple choice question with two optional answers was printed at the top of the paper, followed by two columns of lines. Children wrote their name in the column of their choice answer. There was a small illustration at the top of each column to assist non-readers. While students were obligated to write their name on the daily sign-in sheet and snack log, the Question of the Day, like the ten core handwriting works, was an optional activity that was used to gauge motivation.

The daily participation rate for the core handwriting work was determined by dividing the number of works selected by the number of students in attendance. The daily participation rate for the Question of the Day was determined by dividing the number of students who answered the question by the number of students in attendance. Figure 9 shows the percentage of students who selected each type work during each day of the four-week intervention period. The blue

columns depict the percentage of students who selected at least one of the ten core handwriting works that were tracked on the daily tally sheet. There was no data collected on core handwriting work on day 10 or 18 as the class was involved with other activities.

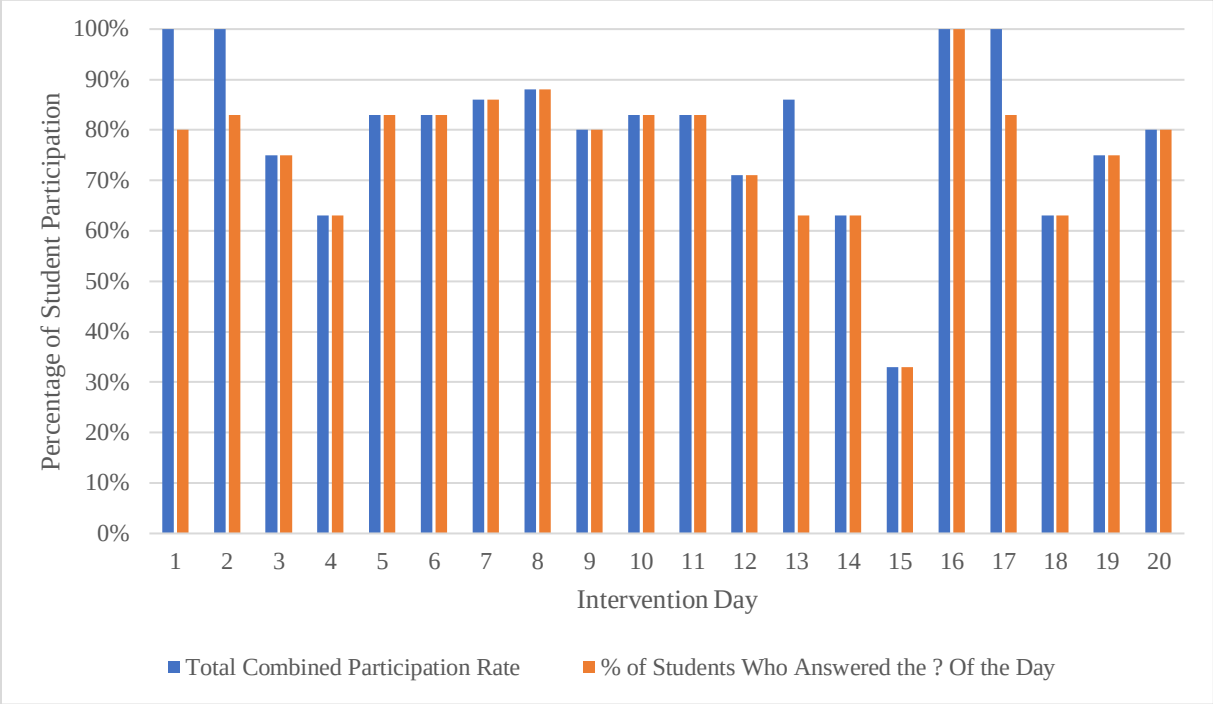


Figure 9. Daily rate of student engagement in core handwriting work and Question of the Day.

The average participation rate for the ten core handwriting works was 50%. The Question of the Day turned out to be a very popular activity with an average participation rate of 76%. The children were excited to see which answer would "win," and frequently visited the desk throughout the morning to see how the voting was progressing. The popularity of the Question of the day boosted the combined participation rate in all handwriting work. Figure 10 shows the combined participation rate of all handwriting work never dipped below 33% and generally hovered above 80%.

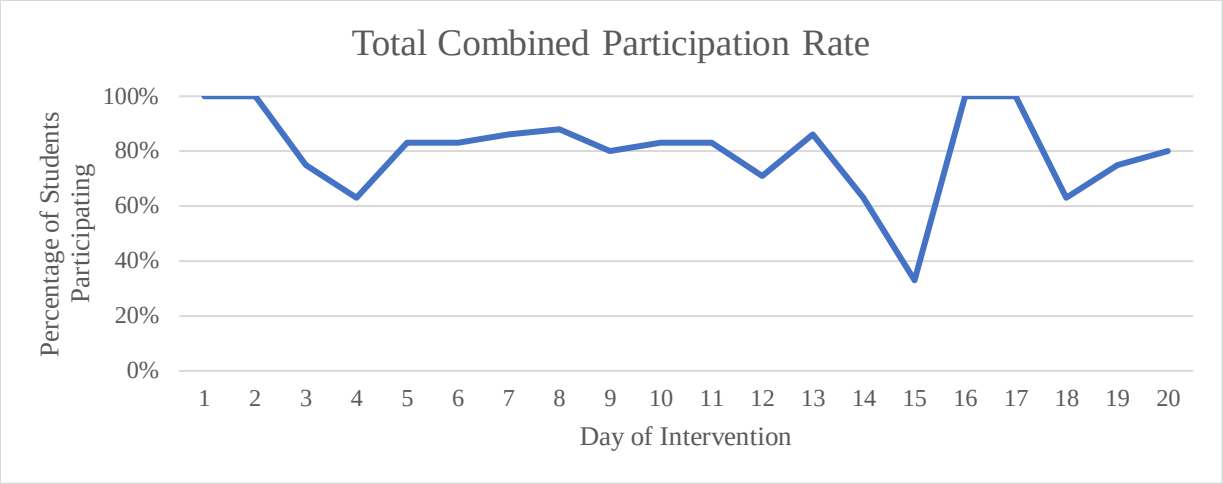


Figure 10. Daily participation rate of all handwriting work combined.

Age as a factor in motivation

The data collected on the daily tally sheet and question of the day also made it possible to determine the total number of handwriting works completed by each age group in the classroom and which type of work was preferred by each age group. As there was only one four-year-old in the class, his data was combined with the five-year-olds, so that each age group contained four students. Figure 11 shows that although the age groups were evenly split with four students in each group, the older group selected handwriting work 122 times, while the three-year-olds selected handwriting work 77 times.

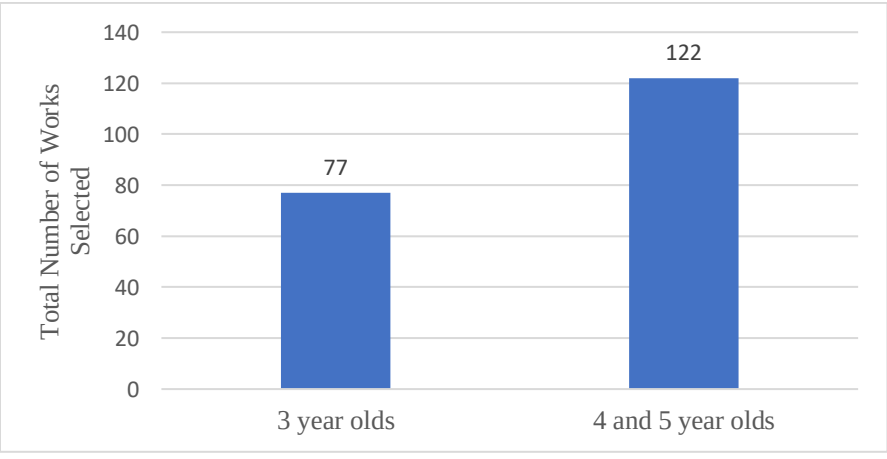


Figure 11. Number of handwriting works selected by age.

Age was also a factor in which type of handwriting work was selected. The three-year-old students selected core handwriting 42 times and Question of the Day 35 times. The four and five-year-olds, in contrast, participated in Question of the Day 67 times and they selected core handwriting work 55 times. (see Figure 12).

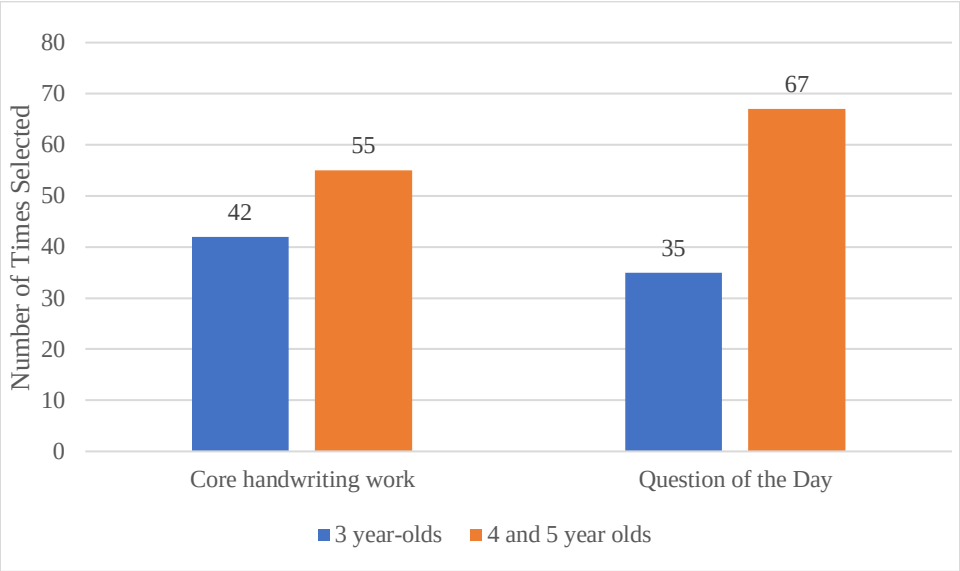


Figure 12. Type of handwriting work selected by age.

One aspect of the research question was if the addition of new multisensory handwriting work would increase motivation for handwriting. Of the ten core handwriting works that were tracked, five of the materials were new and five were in the classroom before the intervention. The new materials were far more popular than the old materials. New materials were selected 76 times, which was 68% of all work choices. The old materials were selected 36 times, which was 32% of all work choices (see Figure 13).

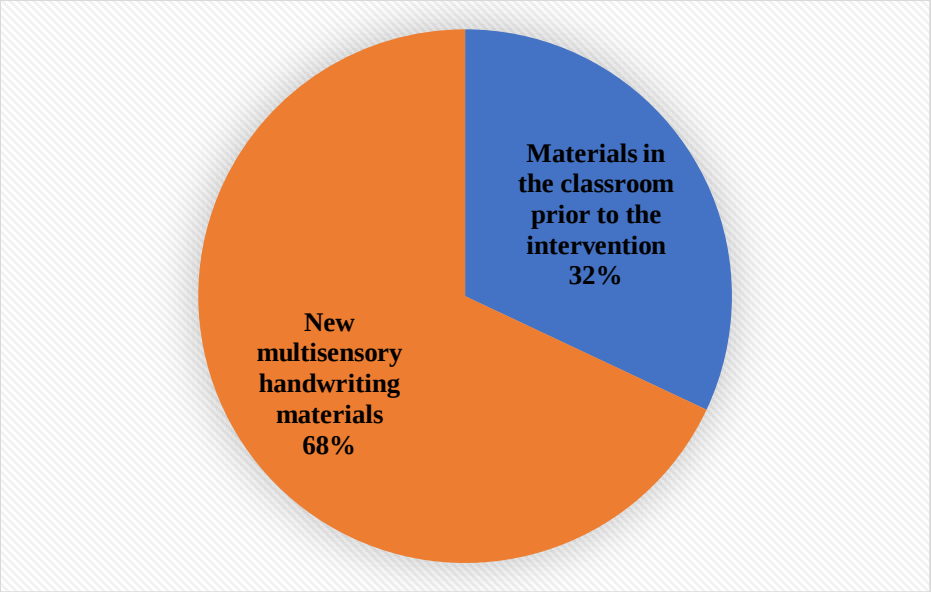


Figure 13. Students' choice of handwriting materials, new vs. prior

Students' Feelings Regarding Handwriting

The three five-year-old students were interviewed after week one and week four of the intervention. The four-year-old student declined to be interviewed. The three-year-old students were not in the position to be able to answer the questions, as they were brand new to the classroom and could not differentiate between the old and new writing work and materials. In both interviews two of the three five-year-old students said they felt "good" about handwriting work and would like to have more of it in the classroom (teacher/student conversations, Setpember 18, 2020 and October 9, 2020). The third student claimed that he felt "not happy" about writing work and stated, "all you have to do is write; I like to do things that are fun" (teacher/student conversations, September 18, 2020 and October 9, 2020). Despite his responses in the interviews, the student participated regularly throughout the intervention. All three of the students identified their name as their favorite thing to write. Two students identified the pencil grips as their favorite new writing utensil and one stated that triangular pencils were her favorite new writing utensil. All three students identified the white board as their favorite new writing

work. Their choice of the white board during the interview was supported by the data collected on the daily tally sheet. Figure 14 shows that the white board was a clear favorite for the class as a whole; it was selected 29 times, which was nearly double the usage of the second most selected material, the tracing board with stylus.

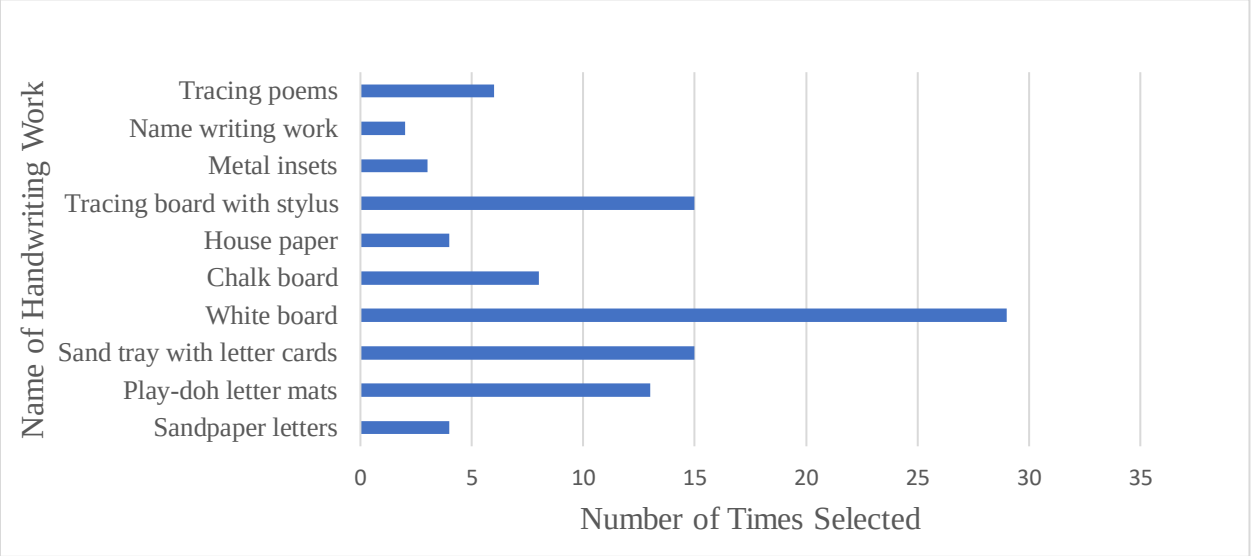


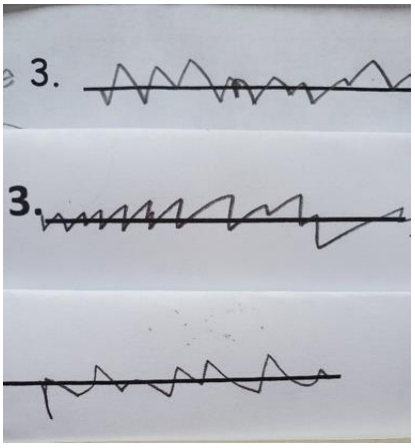
Figure 14. Comparative use of core handwriting work.

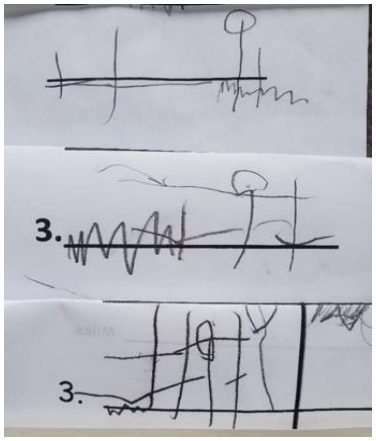
Quality of Independent Letter Formation

In addition to increasing motivation for handwriting, the second goal of the research was to increase students' ability to correctly form letters independently. Three data tools were used to collect samples of student writing. The Question of the Day was an optional activity. The daily sign-in sheet and snack log were obligatory. A total of 210 samples of students' name writing was collected from all three sources over the four-week period. Of the eight students included in the research, three of the students, all three years-old, never attempted to form any letters and chose to "sign" their name with a line throughout the intervention. The other five students are presented as students 1-5 in the data that follows. Handwriting samples were

examined with four aspects of letter formation in mind: legibility, appropriate case, reversals, and writing on the line.

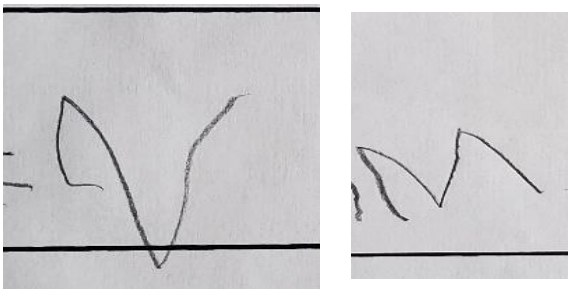
Student 1 was a three-year-old girl in her first year in the classroom. At the beginning of the intervention the child mimicked a signature by writing up and down as shown in the writing samples from day 9 of the intervention (Figure 15). On day 18 of the intervention her writing includes the letters t, and i across all three data sources (Figure 16).





Figures 15 and 16. Student 1 samples from days 9 and 18 showing emergence of letters i and t.

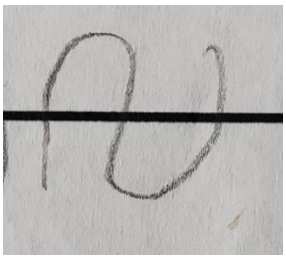
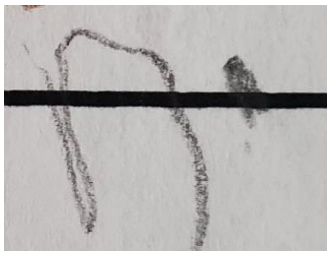
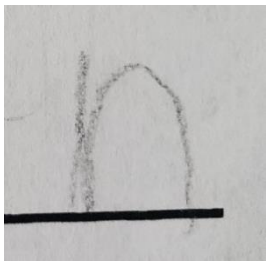
Student 2 was a four-year-old boy in his second year in the classroom. Student 2 was only present for half of the intervention days due to scheduling and illness. Of all the students, he participated the least in the ten core handwriting works (i.e., four times) and the Question of the Day (five times). Despite his absence, his name writing changed over the course of the intervention. The following photos have been cropped in order to show changes in handwriting while preserving the confidentiality of the students by not showing their full names. The sample from day 3 (figure 17) shows his name written with the letter n instead of m. The six letters of is full name were also written out of order (not shown). The second sample is from day 13 (figure 18), the last day he was present during the intervention. It shows that he began to write "M" instead of "N" and correctly ordered the letters of his name.



Figures 17 and 18. Student 2 samples from day 3 and day 13.

Student 3 was a five-year-old girl in her third year in the classroom, but 6-9 months younger than the other five-year-old students. After the six-month school shutdown for Covid-19, student 3 entered the classroom at the beginning of the year able to write the letters of her name in capitals. Her name writing varied widely over the course of the intervention as she frequently rearranged the letters of her name. During individual lessons we focused on writing lowercase letters, but the only appearance of a lowercase letter in her own writing was on day 7 of the intervention, when "h" was the letter of the day. The lowercase h appears in her name on the Question of the Day sheet, but not on the snack log, which was also signed after the morning lesson was given. Other than this example, the student's name writing remained virtually unchanged at the end of the four-week intervention.

Student 4 was a five-year-old girl in her third year in the classroom. She had a high level of competence at the beginning of the intervention. On day 1 she was able to legibly write her full name in a mix of capital and lowercase letters (figure 19). On day 2 she received an individual lesson on the letters of her name with OG practice sheets. She wrote the lowercase n on day 3 of the intervention and each day thereafter (figure 20). By the final day of the intervention she was able to write her name on the line (figure 21).

Figures 19-21. Samples showing progress from uppercase to lowercase, and then to writing on the line.

Student 5 was a five-year old boy in his third year in the classroom. He was the only student interviewed that did not say that he felt "good" about handwriting and that he wished for less handwriting work in the classroom (teacher/student conversations, September 18, 2020 and October 9, 2020). As discussed, his opinions on the survey did not impact his participation in the handwriting activities. His name writing was well-established at the beginning of the intervention with only one letter reversal (Figure 22). On days 11 and 12 he had individual lessons which included OG practice sheets for each letter of his name. On day 14 of the intervention he correctly wrote the previously reversed letter on all three name writing sheets (Figure 23). Similar to the case of student 4, giving the student a direct, individual lesson on the letters of his name had an immediate impact on his ability to correctly form the letters independently.


Figures 22 and 23. Student 5 samples from day 1 and day 14 showing corrected letter reversal.

Overall, the increased name-writing opportunities, combined with the extra handwriting materials, had a positive impact on the quality of student handwriting. Impacts ranged from corrected letter reversals and appropriate use of lowercase letters, to the emergence of legible letters where there had been none. The most immediate impacts occurred when the student was given a direct, individual lesson on the letters of his or her name.

Action Plan

The purpose of this research project was to observe the impacts of a revised handwriting curriculum. The data supports that the students were highly motivated to engage in handwriting activities. The combined daily participation rate in all handwriting activities generally hovered above 80%. It is not possible to statistically prove that motivation increased during the intervention due to a lack of pre-intervention participation data. However, because there was twice as much handwriting work available, and the students selected the new work 68% of the time, it is reasonable to suggest that the intervention increased motivation for handwriting.

Students showed improvement in independent correct letter formation, as evidenced by changes in name writing samples taken during the intervention. Changes included the emergence of legible letters, correction of reversed letters, corrected spelling, and the appropriate use of lowercase letters. The four-week time frame for data collection was a limitation of this study. Gains were modest during the four-week time frame, however, the students continued to improve after the research period ended. For example, student 3 consistently wrote only 2/3 of her complete name and used all capital letters, except for the single sample containing lowercase h. Three weeks after the research period ended, she independently wrote her entire name in the correct order with correct placement of upper and lowercase letters.

Age was a factor in which work was more popular. The four and five-year-olds participated more in the Question of the Day activity than in the ten core handwriting works that were tracked on the daily tally sheet. The opposite was true for the three-year-olds, who were more likely to select from the ten core handwriting materials. This may indicate that the older students were more comfortable with paper and pencil. The core handwriting materials may have been more appealing to the younger students due to the variety of multisensory options, including sand and play-doh, as well as various writing utensils, including markers and chalk. As discussed in the literature review, there is no consensus on the appropriate age to teach handwriting. The preferred work of each age group may impact the decision of how and when to teach handwriting. Multisensory activities such as the sand tray, play-doh mats, or even the whiteboards may be a starting point for younger students, instead of pencil work. Students were very attracted to the whiteboard and chose this material more than any other new material. The reasons for this may have been the novelty of using markers, the small portable size, or the erasability. The whiteboard is similar to the traditional Montessori chalkboards because students can repeatedly write and erase until they are satisfied with their results. Unlike paper and pencil, the whiteboard leaves no record of failed attempts. The children's attraction to this material makes me wonder if Maria Montessori would have used it in place of the chalkboards, had it been invented at the time she lived.

The students' use of capital letters was an ongoing challenge throughout the intervention. During an individual lesson with student number three, a five-year-old, I explained that capital letters are only for the first letter of the name. She was adamant that her name written in all capitals was correct and told me, "that is how it looks on my wall at home." When I asked her mom, she explained that she placed a wall hanging in the student's bedroom with her name

written in capital letters. Though I know that this was a design decision rather than an educational decision, it did cause me to wonder why children enter the classroom knowing capital letters. Is it because they received explicit instruction from a parent, learned them from children's programming, or merely perceived them in the environment? As a primary (3-6) teacher, I will continue to encourage parents and caregivers to focus on lowercase letters when they write with their children; and it might be useful to share this advice with the toddler parents at my school as well.

Recommendations

Overall, the revised handwriting curriculum and new writing materials were useful in this Montessori 3-6 classroom. Like the surveyed teachers referenced in the literature review, I felt my handwriting training was lacking, and I felt confident using the OG method as the basis for this intervention. I will continue to use the Didax sandpaper letters in conjunction with the Montessori sandpaper letters to reinforce proper letter formation. The feature letter of the day was not useful for every student. For one student, her name did not include the feature letter of the day until day nine of the intervention. The pace of one letter per day was too fast to encourage mastery. However, it made sense to present as many letters as possible during the four-week research period and I will repeat that process in the future. I will also retain the three daily name-writing activities (i.e., sign-in book, snack log, and Question of the Day). I think additional activities rotated with the Question of the Day could help maintain interest in the long run. One major limitation of this action research project was the small sample size. One could repeat the project with a larger class and gather pre-intervention data on participation before introducing the revised curriculum and the new materials. Future research could explore the use of cursive materials alongside manuscript materials as an extension or alternate choice for

children who are interested. Future research could also examine how changing the order of presenting the letters impacts the other language materials currently used in the classroom. For example, prior to the handwriting intervention, the letters were divided into five baskets which each included one vowel. This system was compatible with the Pink/Blue/Green series language materials which are also used in the classroom. Reordering the sound baskets eliminates the compatibility between the two materials and may require additional modifications to the comprehensive language curriculum.

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Appendix A

Teacher/Student Conversation Questions for Handwriting Research Project

Student Number: _____ Date: _____

1. Which of our new handwriting works do you enjoy the most?

2. Which of our new handwriting materials do you like to use?

   (house paper, triangular pencils, pencil grips, etc.)

3. What is your favorite thing to write?

4. How do you feel about handwriting?

5. Would you like to have more, or less handwriting work in our classroom?

Appendix B

Handwriting Research

Week _____ Date: _____

	Plan	***Actual***
M		
T		
W		
T		
F		

Appendix C

Treehouse Daily Sign-in Sheet Date: _____

1. Student Name 1 _____

2. Student Name 2 _____

3. Student Name 3 _____

4. Student Name 4 _____

5. Student Name 5 _____

6. Student Name 6 _____

7. Student Name 7 _____

8. Student Name 8_____

Appendix D

Question of the Day

Date: _____

_____

_____ ?

(illustration) -or- (illustration)

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

Appendix E

Snack Log Date: _____

1. _____ Student 1

2. _____ Student 2

3. _____ Student 3

4. _____ Student 4

5. _____ Student 5

6. _____ Student 6

7. _____ Student 7

8. _____ Student 8

Appendix F

Daily Tally Sheet for Handwriting Work Utilization

Date: _____ Time: _____

Work:	Tally:	Total:
Sandpaper letters	_____	_____
Play-doh letter mats	_____	_____
Sand Tray with letters	_____	_____
Letter of the day:		
white board	_____	_____
chalk board	_____	_____
house paper	_____	_____
Tracing boards w/stylus	_____	_____
Metal insets	_____	_____
Name Writing work	_____	_____